



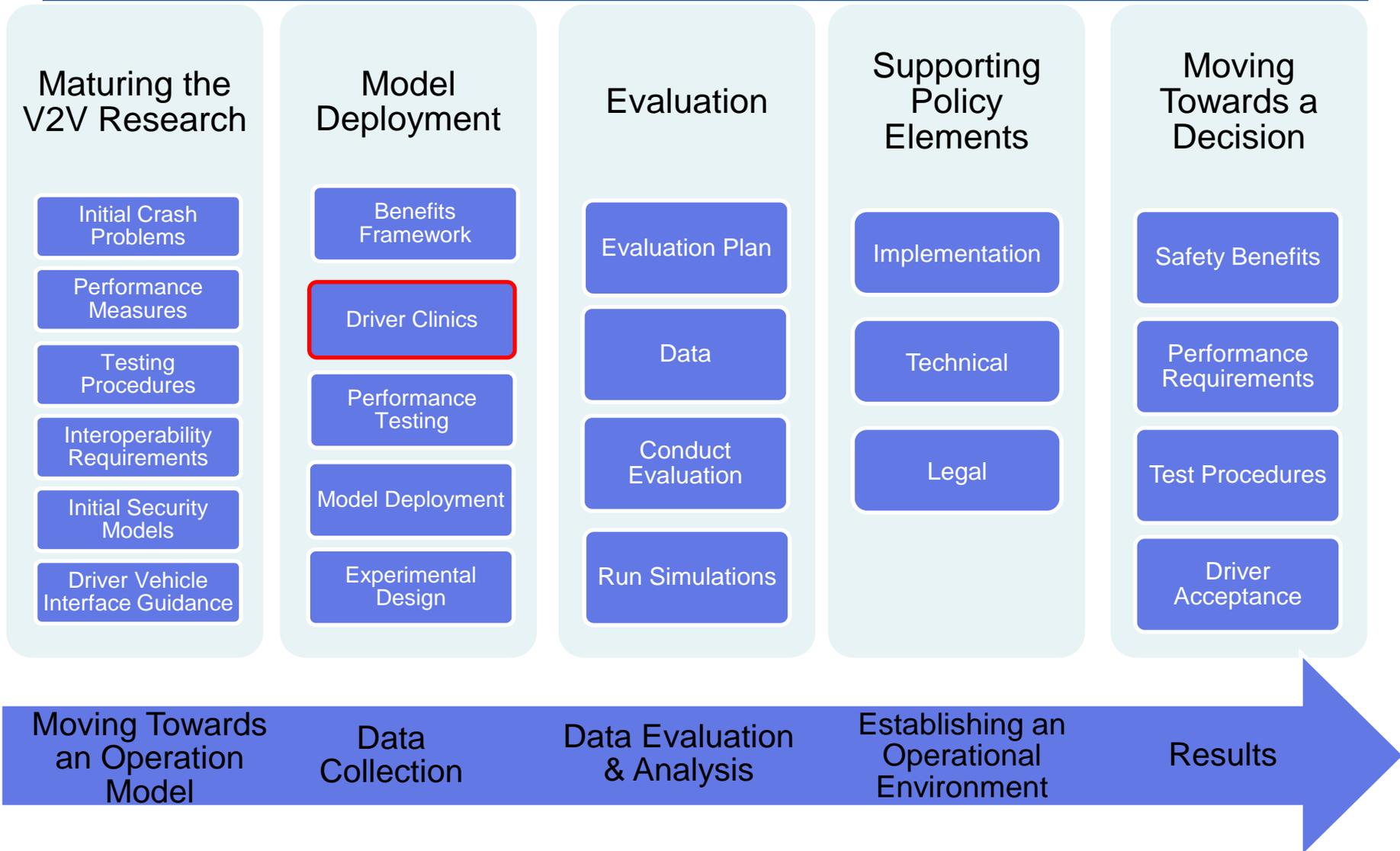
*UNITED STATES*  
**DEPARTMENT OF TRANSPORTATION**

# **LIGHT VEHICLE DRIVER ACCEPTANCE CLINICS**

USDOT ITS Connected Vehicle Workshop

Mike Lukuc, NHTSA Research  
September 25, 2012

# V2V SAFETY FRAMEWORK



# LIGHT VEHICLE DRIVER ACCEPTANCE CLINIC (DAC) PROJECT SCOPE

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## Objectives:

- Obtain feedback on connected vehicle technology and safety applications from a representative sample of drivers
- Assess the performance and reliability of 5.9 GHz DSRC communications and GPS in diverse geographic locations and environmental conditions...and
- Promote V2V-based safety technology and potential safety benefits



# DAC PROJECT TEAM

**CAMP**  
*Vehicle Safety Communications 3*

Mercedes-Benz  
Research & Development North America, Inc.

**GM**

**TOYOTA**

**HONDA**  
Honda R&D Americas

**Ford**

**NISSAN**

**HYUNDAI KIA MOTORS**  
Hyundai-Kia America Technical Center, Inc.

**VOLKSWAGEN**  
GROUP OF AMERICA

*Intelligent Transportation Systems*



**AUTOMOTIVE EVENTS**

# DAC LOCATION MAP

Michigan International Speedway  
Brooklyn, MI (Aug 2011)



Brainerd International Raceway  
Brainerd, MN (Sept 2011)



VTTI Smart Road  
Blacksburg VA (Nov '11)



Alameda Naval Air Station  
Alameda CA (Jan 2012)



Texas Motor Speedway  
Fort Worth TX (Dec '11)



Walt Disney World Speedway  
Orlando, FL Oct 2011)



# DAC VEHICLE RESOURCES

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- 16 V2V equipped vehicles
  - 2 from each OEM
  - 8 for use by participants (host vehicles)
  - 8 for use by AE professional drivers during scenario execution (remote vehicles)
- 8 additional V2V equipped “template” vehicles
  - Available as spares for DAC if needed
  - Intended for performance testing (have additional instrumentation)
- DAC vehicles are 16 of the 64 integrated vehicles that will be deployed in Safety Pilot Model Deployment (Ann Arbor, MI)



# V2V SAFETY APPLICATIONS...

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- EEBL: Emergency Electronic Brake Lights
- FCW: Forward Collision Warning
- BSW/LCW: Blind Spot Warning/Lane Change Warning
- LTA: Left Turn Assist
- IMA: Intersection Movement Assist
- DNPW: Do Not Pass Warning



# SAFETY APPLICATIONS BY OEM

- V2V Applications & Scenarios

- Run the following applications (# of scenarios)
  - EEBL (1); FCW (4); BSW/LCW (2); DNPW (2); IMA (2); LTA (1)

Applications	Ford	GM	Honda	Mercedes	Toyota	Hyundai- Kia	Nissan	VW-Audi
EEBL	X	X	X	X	X			X
FCW	X	X	X	X		X	X	X
BSW / LCW	X	X	X	X	X	X	X (BSW)	
DNPW	X	X	X					
IMA	X	X	X	X	X			X
LTAP / OD							X	



# DRIVER VEHICLE INTERFACE (DVI) EXAMPLES

- OEM specific DVIs
  - Audible, visual and / or haptic



# PARTICIPANT EXPERIENCE

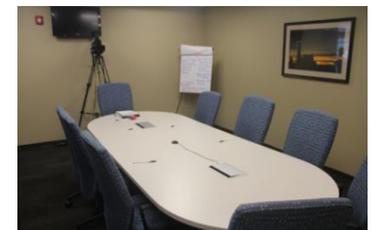
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- Arrival
- Registration
- Pre-drive questionnaire
- Briefing
- Orientation to vehicle and station
- Safety Feature Exposure
- Questionnaire (after each application)
- Post Drive Questionnaire
- Focus Group (if applicable)



# SAFETY APPLICATION EXPOSURE

- 112 participants over a 4 day period
- Typically, 4 sessions per day at 8 participants each
- Participants are:
  - Equally split by gender
  - Equally split into three age categories (20-30, 40-50, 60-70)
- Participants experience each V2V safety feature
- After each exposure the experimenter asks a series of questions
  - Captures their immediate impressions
  - Safety Application Effectiveness
  - Relevance of Driver Vehicle Interface (DVI)
- Focus Groups



# DEMOGRAPHIC AND APPLICATION EXPOSURE BREAKDOWNS

## DAC - Overall

Age	Male	Female	Total
20-30	117	111	228
40-50	115	117	232
60-70	115	113	228
<b>Total</b>	<b>347</b>	<b>341</b>	<b>688</b>



	EEBL	FCW	BSW-LCW*	DNPW	IMA	LTA
<b>Acura</b>	91	88	85	85	91	---
<b>Cadillac</b>	88	87	86	86	88	---
<b>Ford</b>	85	85	85	84	85	---
<b>Hyundai</b>	---	172	87	---	---	---
<b>Infiniti</b>	---	87	173	---	---	173
<b>Mercedes</b>	87	87	87	---	87	---
<b>Toyota</b>	172	---	85	---	172	---
<b>VW-Audi</b>	165	82	---	---	165	---
<b>Total</b>	<b>688</b>	<b>688</b>	<b>688</b>	<b>255</b>	<b>688</b>	<b>173</b>
<b>% of Overall</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>37%</b>	<b>100%</b>	<b>25%</b>

\*LCW was not available on the Infiniti



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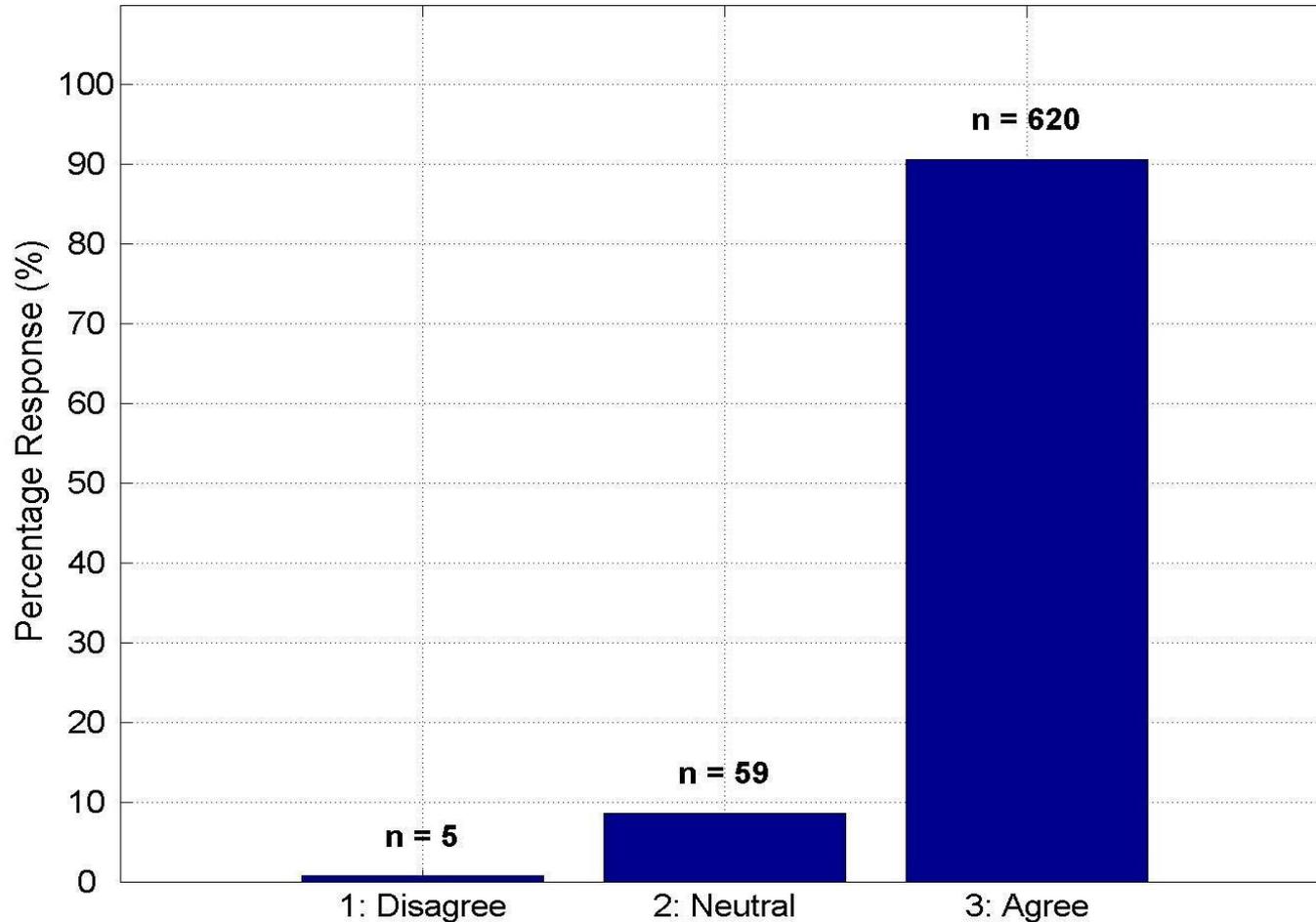
A Single Example Showing The “Big-Picture”

# DRIVERS TEND TO DESIRE V2V TECHNOLOGY



# DESIRABILITY - ACROSS ALL FACTORS

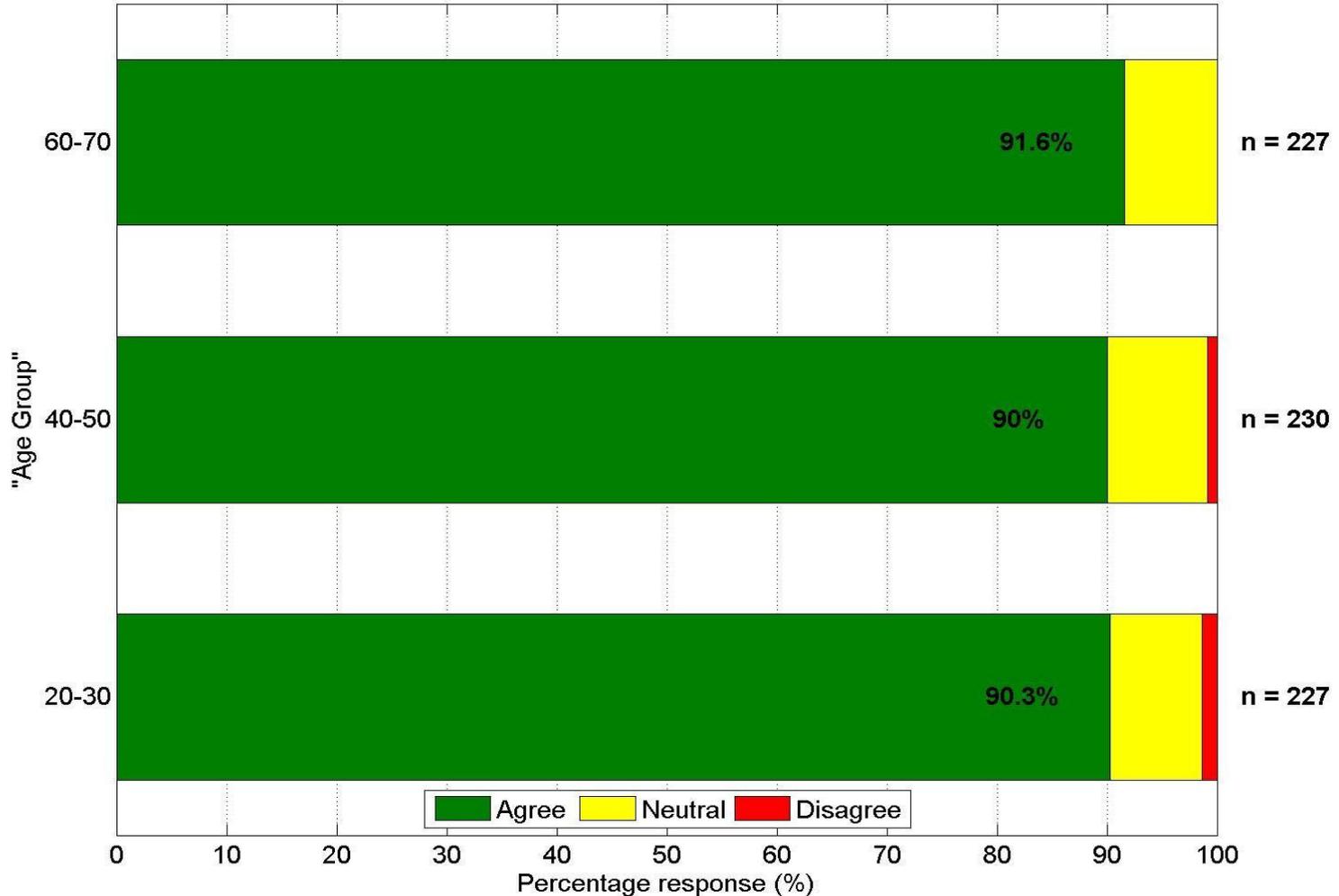
I would like to have this Vehicle-to-Vehicle Communication safety feature on my personal vehicle.



# DESIRABILITY

## ACROSS ALL FACTORS AND PARSED BY AGE

I would like to have this Vehicle-to-Vehicle Communication safety feature on my personal vehicle.



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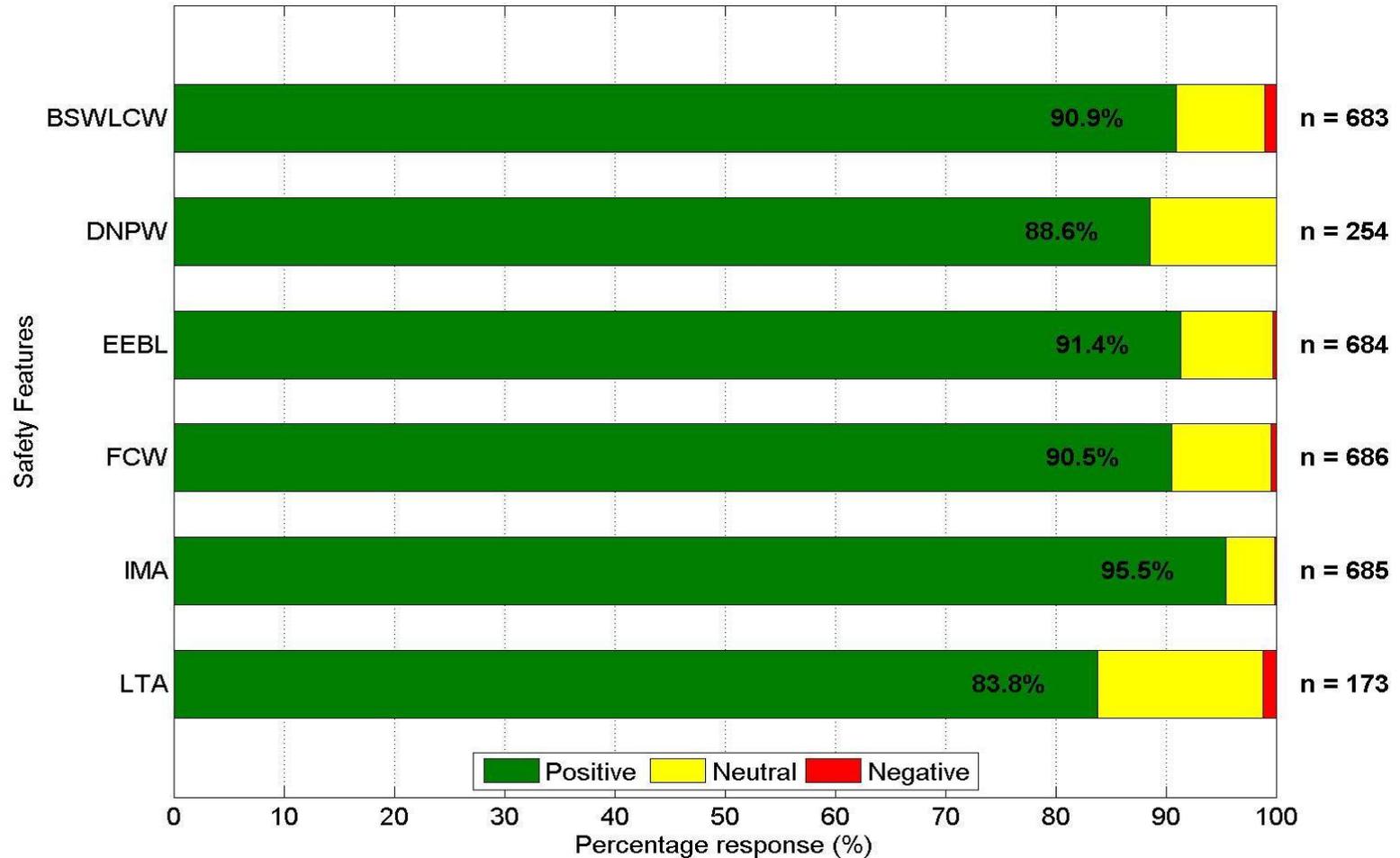
A Few Examples Demonstrating

# DRIVER ACCEPTANCE AS A FUNCTION OF SAFETY FEATURE



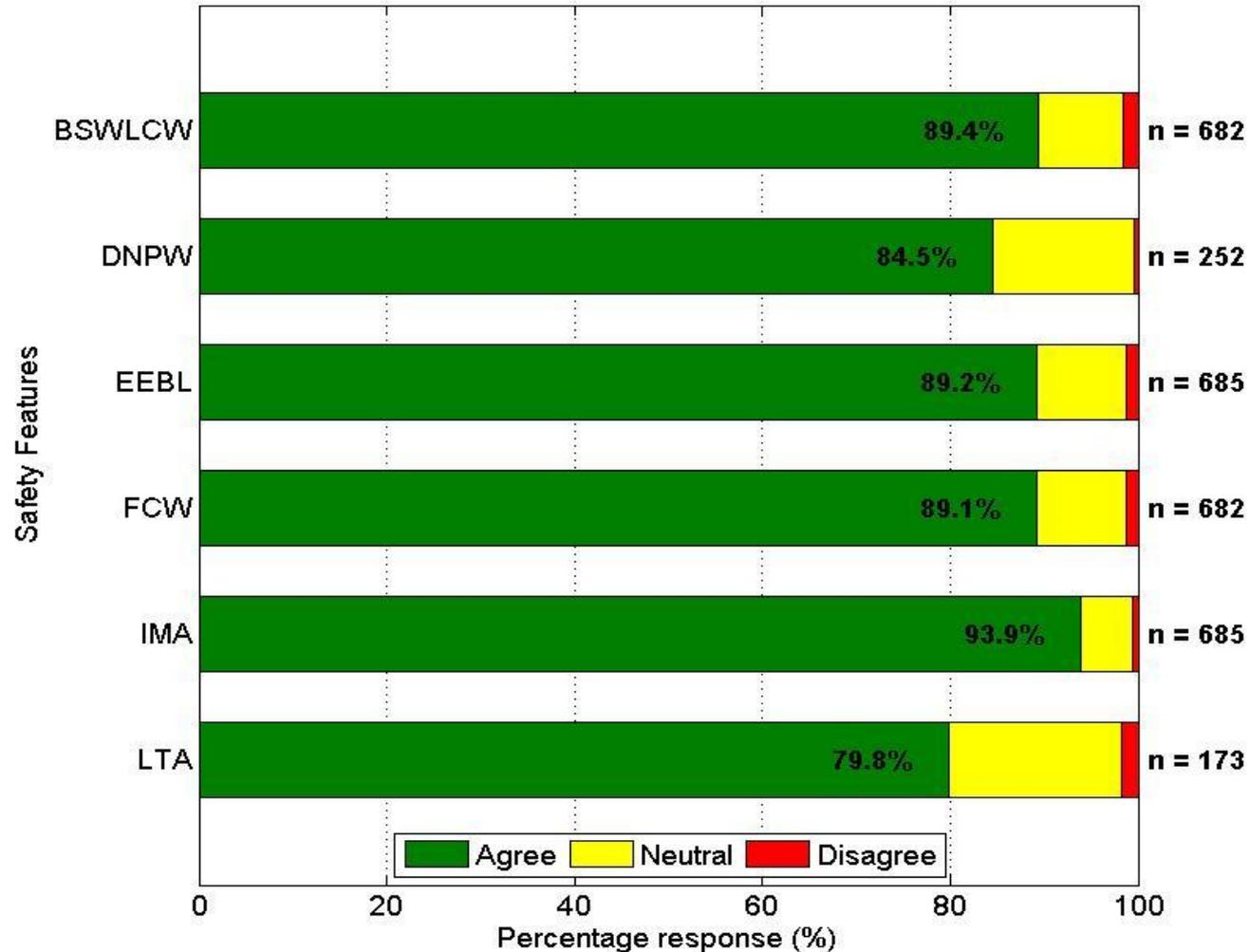
# OVERALL IMPRESSIONS - USEFULNESS

How useful do you think a safety feature that alerted you to the presence of a (specific threat) would be in terms of improving driving safety in the real world?



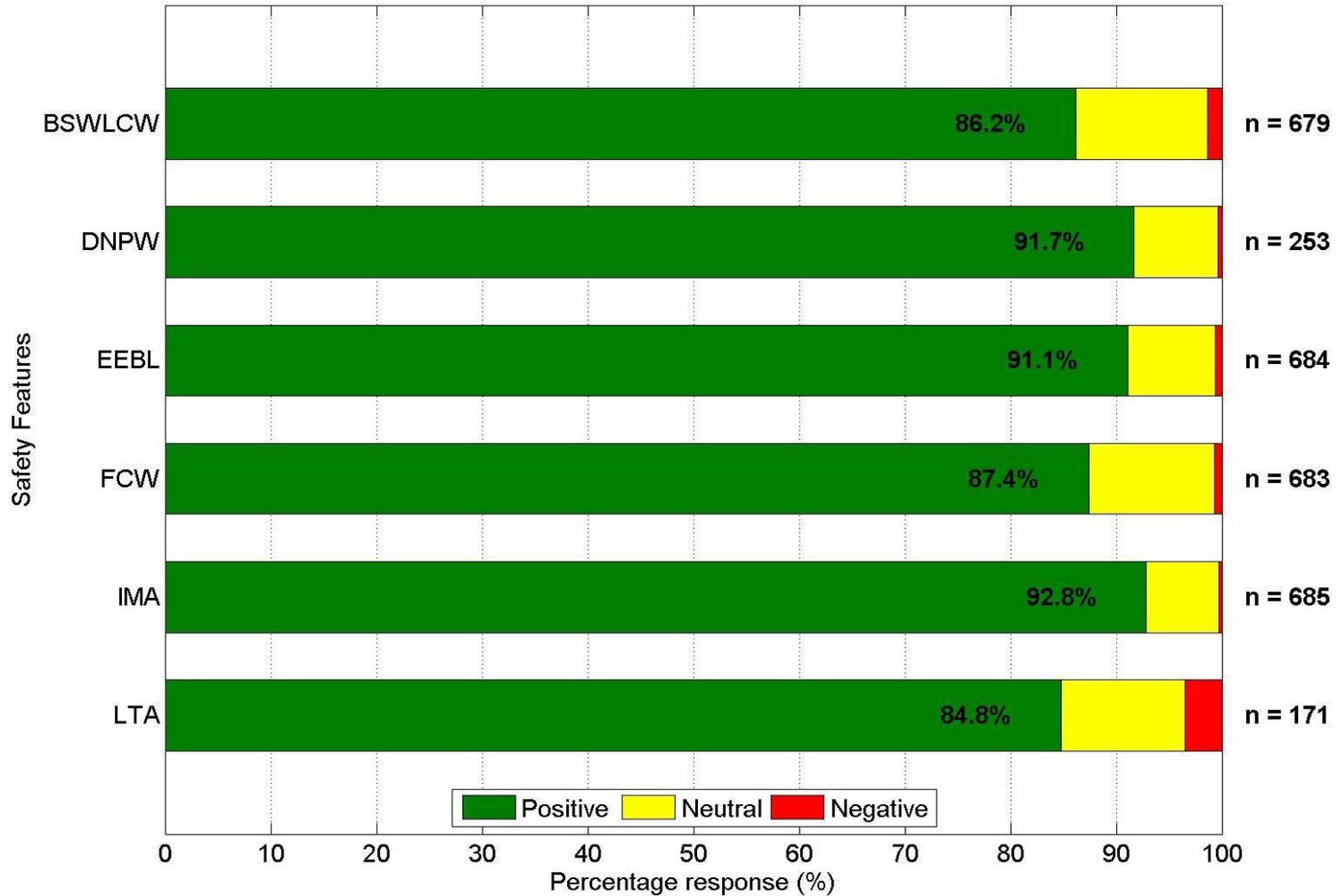
# OVERALL IMPRESSIONS – DESIRABILITY

I would like to have a safety feature that alerted me to the presence of a (specific threat) on my personal vehicle.



# OVERALL IMPRESSIONS - INTUITIVENESS

How effective was this particular safety feature at alerting you to the presence of a (specific threat)?



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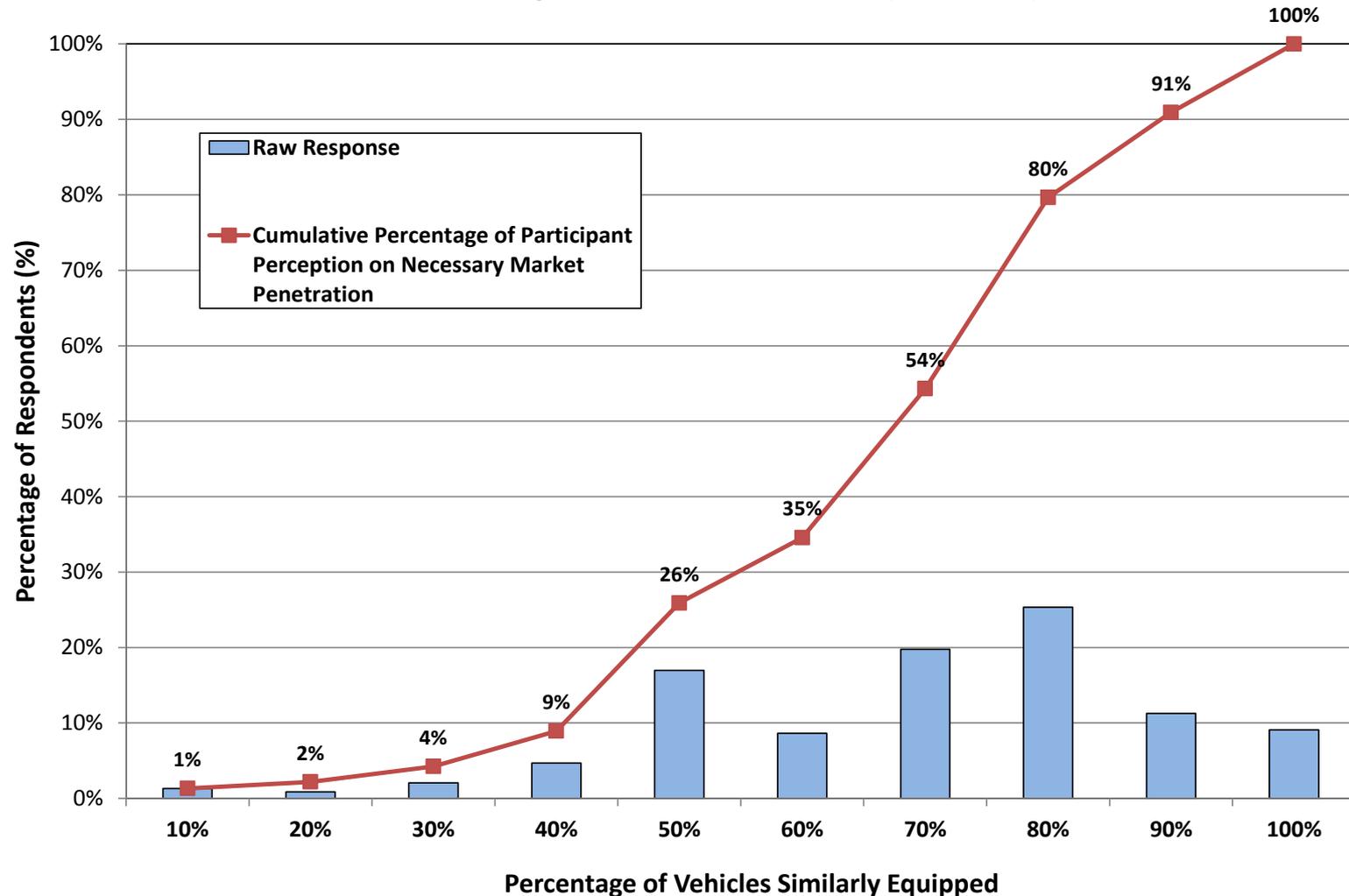
An Example of

# DRIVER'S ASSESSMENT OF SYSTEM LIMITATIONS



# SYSTEM LIMITATIONS - MARKET PENETRATION

*What percentage of vehicles would need to be similarly equipped before you believe the benefits would be noticeable? (select one)*



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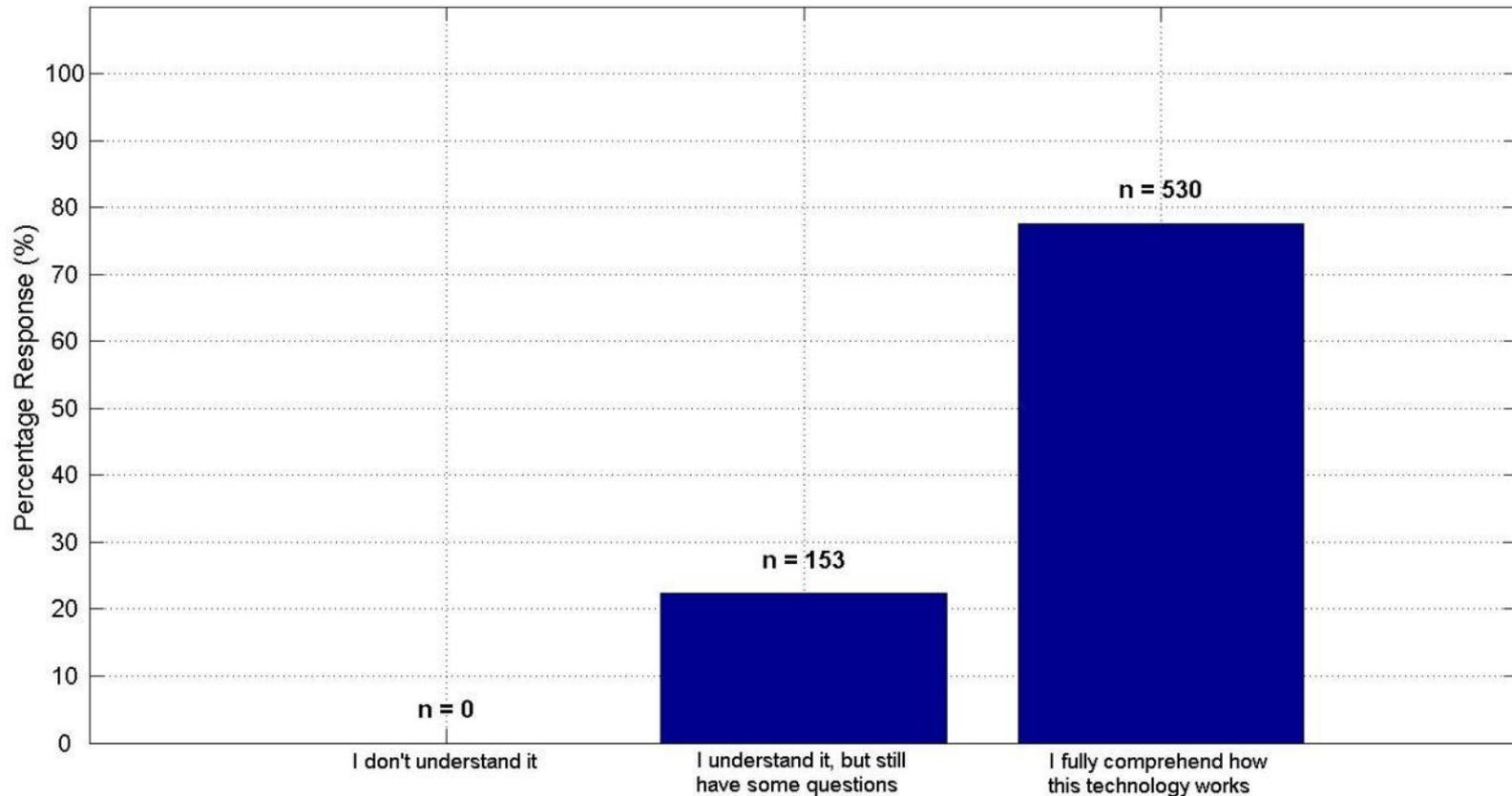
An Example Demonstrating Demographic Relationship to

# SELF-REPORTED UNDERSTANDING OF V2V



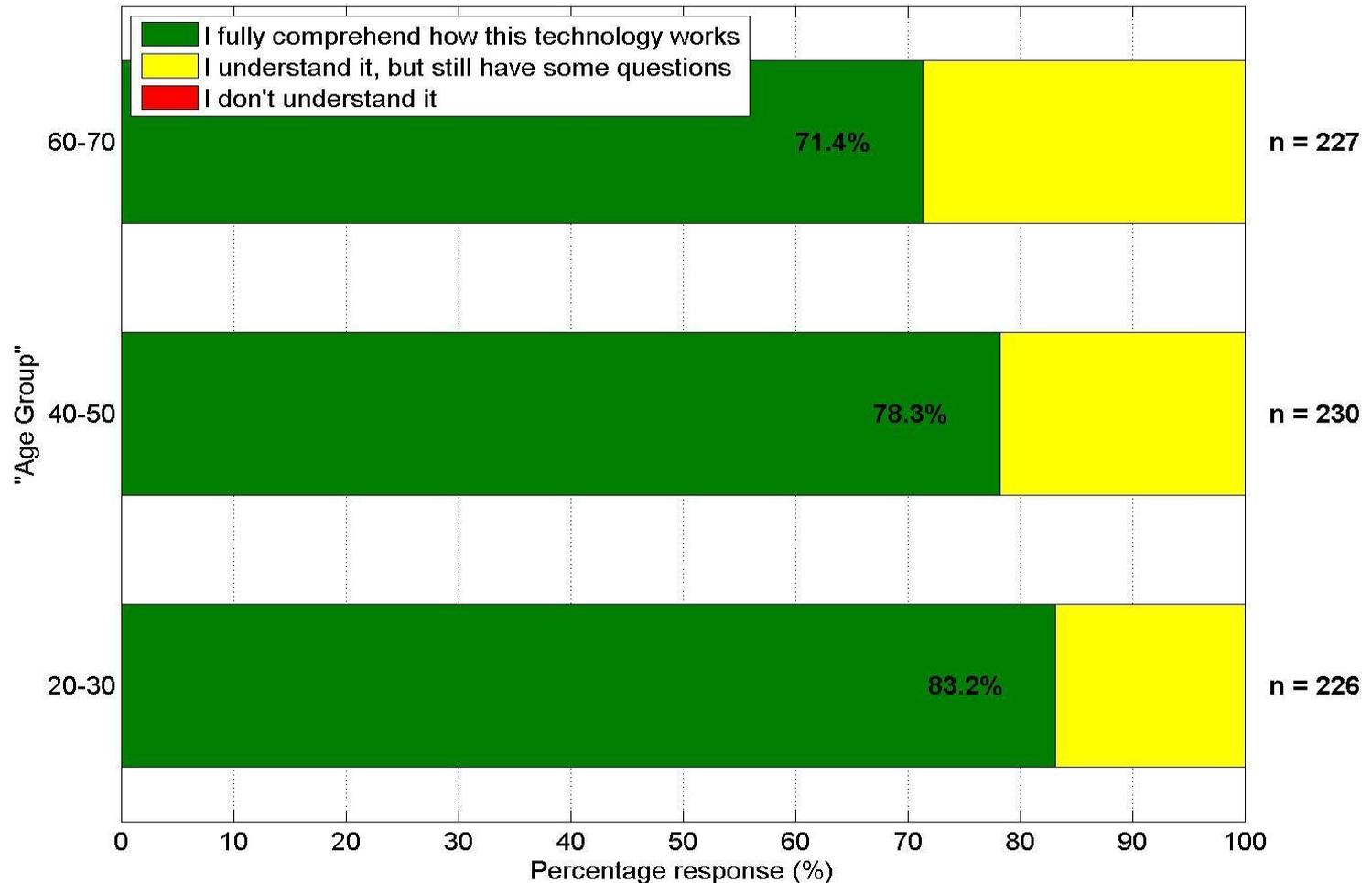
# OVERALL IMPRESSIONS

After experiencing these vehicle-to-vehicle safety features first hand, please tell us how well you think you understand this technology and how it works. (select only one)



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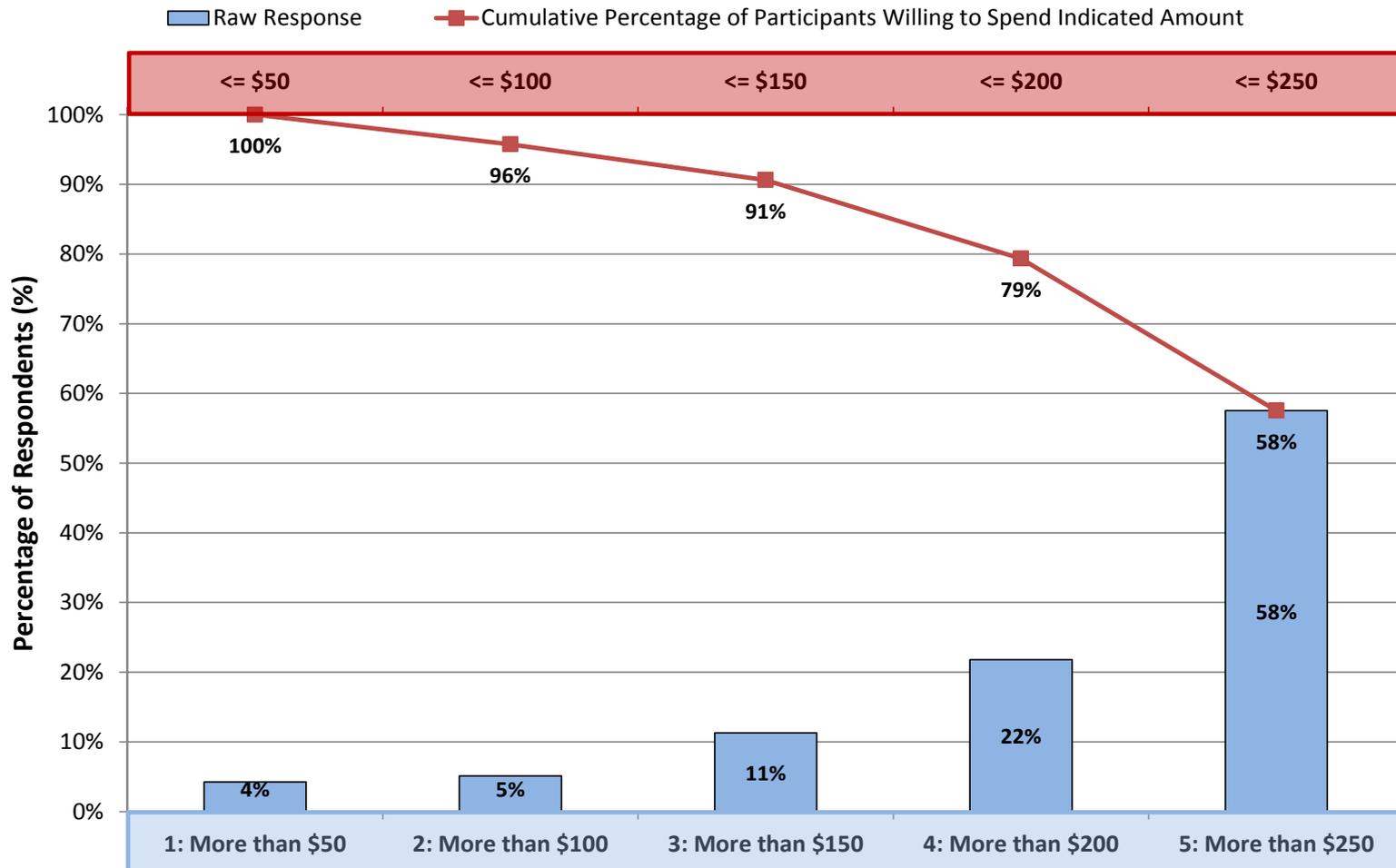
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A Willingness to Pay Example Indicating  
**DRIVER'S VALUE V2V**



# MONETARY VALUE

At what price level might you begin to feel this collective group of safety applications (Vehicle-to-Vehicle communications safety feature) is too expensive to consider purchasing? (select one)



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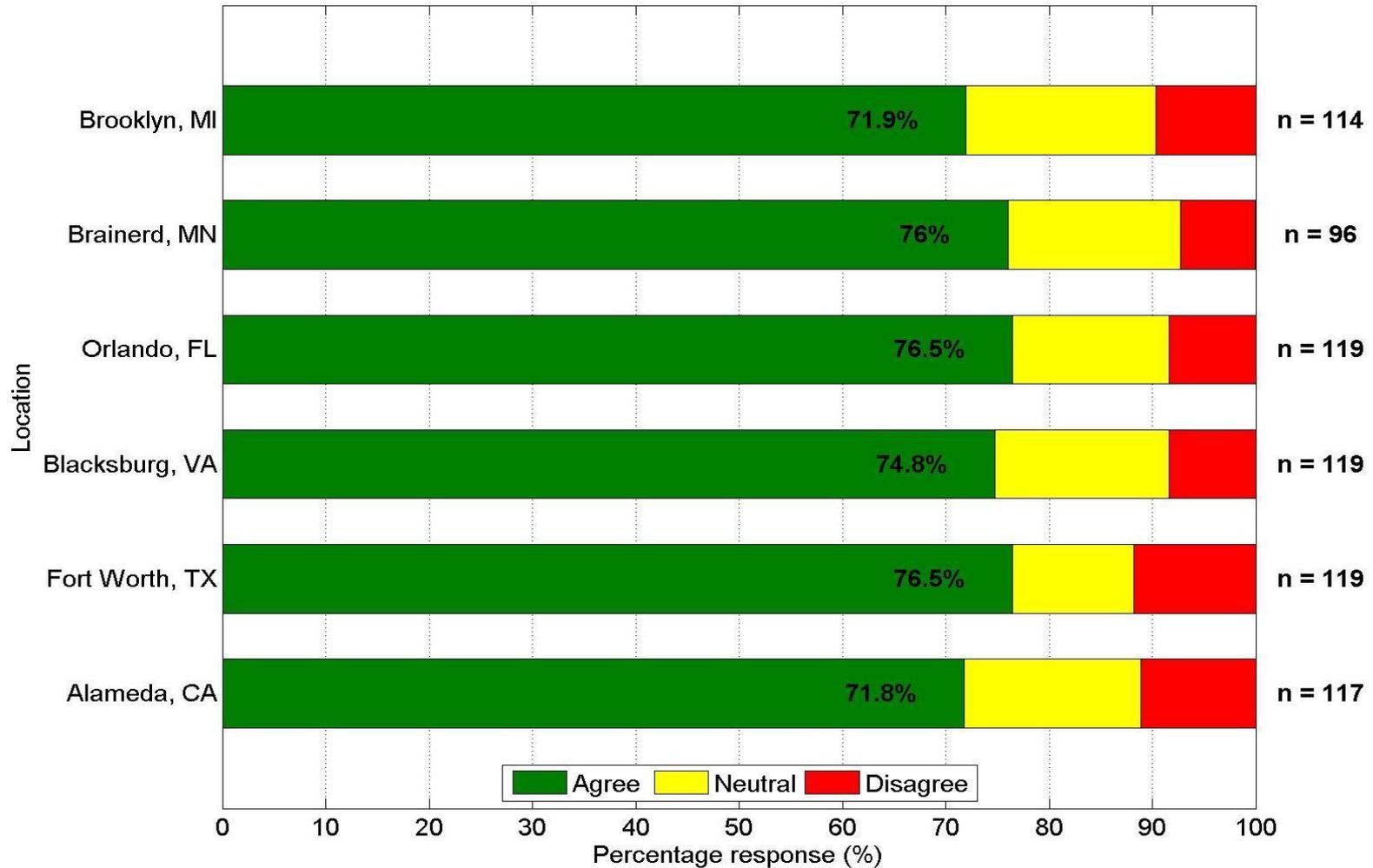
A Couple Examples Asking Drivers About

# UNINTENDED CONSEQUENCES



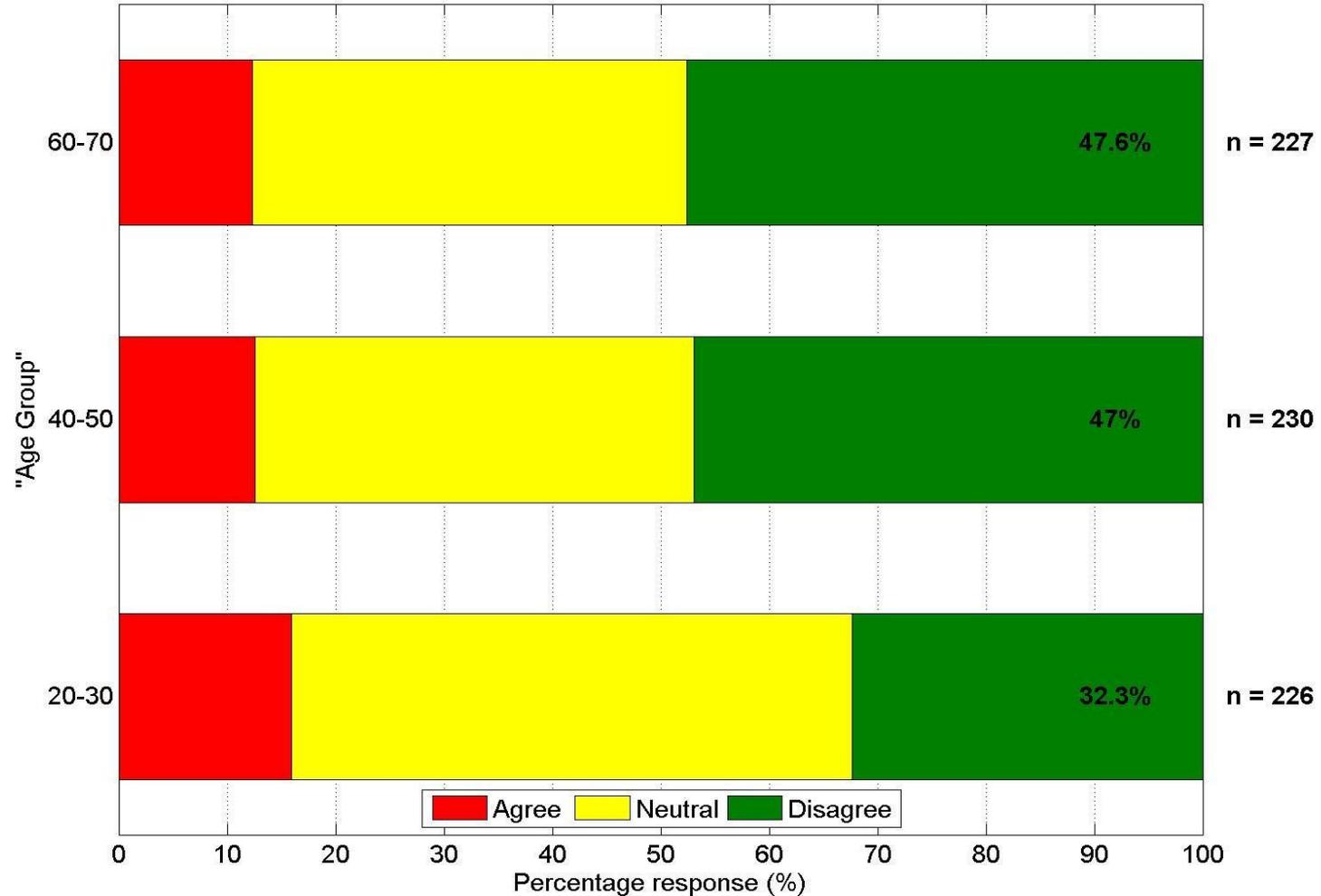
# IMPACT ON SAFETY – DISTRACTION

Monitoring or interpreting information provided by these safety features is no more distracting than using my car's radio.



# IMPACT ON SAFETY – COMPLACENCY

Availability of these safety features would cause drivers to pay less attention to the driving environment.



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Executive Summary

# FOCUS GROUP



# FOCUS GROUP OVERVIEW

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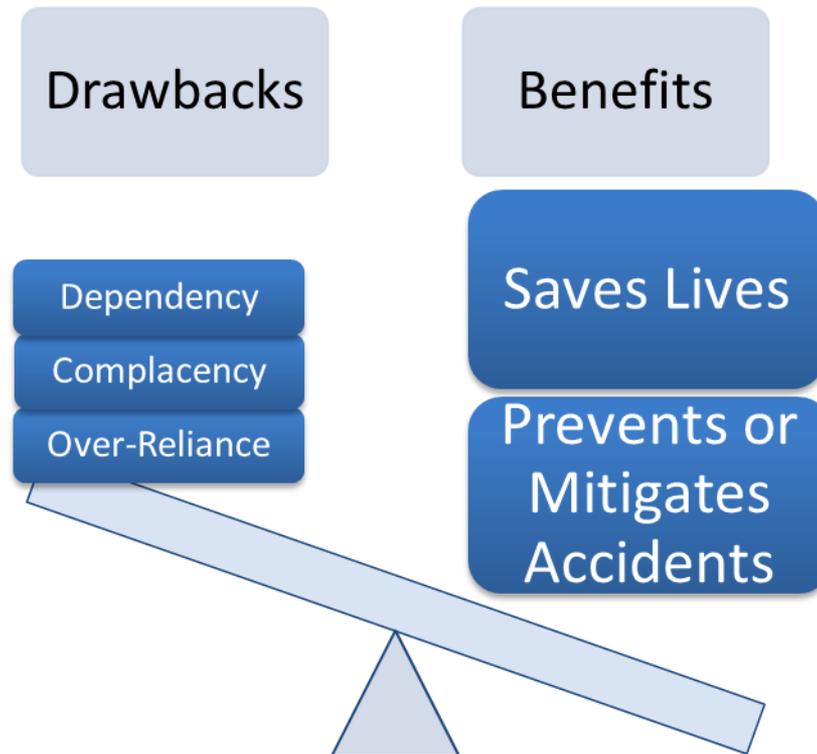
- 12 focus groups were conducted
- Each group was comprised of **eight participants** (for a total of 96) who had just completed the driving portion of the study.
- **Mix of gender and ages** in each group, randomly assigned to participate in each focus group.
- Each participant per focus group had driven one of the eight OEM vehicles, and had experienced the majority of scenarios.



# INITIAL SUMMARY OF OVERALL REACTIONS

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The illustration below demonstrates respondents' most common reactions to this technology ... that **saving a life or many lives, far outweighs the potential drawbacks:**



# NEXT STEPS

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## Publish the Results

- Draft Final Report due from CAMP VSC3 in Sept 2012
  - Must be subjected to NHTSA review process prior to publication
  - Published report will be available on NHTSA and RITA ITS websites:
    - NHTSA :  
<http://www.nhtsa.gov/Research/Crash+Avoidance/Office+of+Crash+Avoidance+Research+Technical+Publications>
    - RITA ITS:  
[http://www.its.dot.gov/connected\\_vehicle/connected\\_vehicle.htm](http://www.its.dot.gov/connected_vehicle/connected_vehicle.htm)





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